MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

ETM3056 – MULTIMEDIA AND COMMUNICATION NETWORKS

(TE)

17 OCTOBER 2016
9.00 a.m – 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 5 pages with 4 Questions only.

2. Attempt **ALL** questions. Each question carries an equal total mark and the mark distribution for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1

(a) Describe four benefits of data compression.

[8 Marks]

(b) ADSL is one example of fixed broadband technologies:

(i) TM's Streamyx Internet bandwidth has reached 8 Mbps. Calculate the time needed (in minutes) to download a 50 minutes drama episode of QCiF (178 x 144) with true colors of 24 bits per pixel and 30 fps video rate.

[5 Marks]

(ii) Propose two methods to reduce the download time.

[2 Marks]

(c) HTML and XML languages are designed for two different applications. Compare and explain one difference and one similarity between HTML and XML languages.

[4 Marks]

(d) Use Huffman coding to encode the string "bookkeeper". Show the binary code for each symbol and the number of bits used to encode the word. The probability of each symbol is given as follows: P(e) = 0.3, P(o) = 0.2, P(k) = 0.2, P(b) = 0.1, P(p) = 0.1, P(r) = 0.1.

[6 Marks]

Continued...

Question 2

(a) International and national work is needed to introduce interoperable Next Generation Networks (NGN).

(i) Name five areas in which the collaborative international and national work must focus on in order to introduce interoperable NGN.

[5 Marks]

(b) Session Initiation Protocol (SIP) is one of the important components in NGN implementation.

(i) Briefly define SIP.

(ii) Describe the roles that SIP plays in NGN implementation.

[2+4 Marks]

(c) Briefly describe the relationship between SIP and IP Multimedia Subsystem (IMS).

[2 Marks]

(d) In the first three Open Systems Interconnection (OSI) layers, there are different hardware components devised to serve some of the operations in the respective OSI layers. Name and explain two devices for each of the following OSI layers:

(i) Layer 1

(ii) Layer 2

(iii) Layer 3

[4+4+4 Marks]

Continued...

Question 3

(a) AT&T (USA) has introduced an analog carrier system to provide a wider range of capacities for the users.

(i) What is the type of multiplexing used in the aforementioned analog carrier system? Briefly explain how the multiplexing technique operates.

(ii) Name three hierarchical levels of the analog carrier system answered in Question 3 (a) (i) and briefly describe each level and the relationship between each level.

[6+6 Marks]

(b) According to International Telecommunications Union (ITU) standards, one group of voice channels in an analog carrier system has exactly 12 channels, each of which requires 4 kHz of bandwidth. One supergroup has 60 groups with the total bandwidth of 240 kHz and one mastergroup has 300 supergroups with the total bandwidth of 1.232 MHz. If a system has a bandwidth of 950 kHz, what is the maximum number of groups and/or supergroups of voice channels which can be supported using the analog carrier system?

[5 Marks]

(c) Synchronous Optical Network (SONET) and Synchronous Digital Hierarchy (SDH) are two digital transmission standards for fiber-optic cables.

(i) What is the core multiplexing technique implemented in SONET and SDH to perform multiplexing operations? Is it asynchronous?

(ii) A network engineer is required to design a single path of a big SONET network. This path should have two lines and four sections. If STS (Synchronous Transport Signal) multiplexers, STS demultiplexers, ADM (add/drop multiplexers) and repeaters are provided, sketch this SONET path to help the engineer accomplish the task.

[2+6 Marks]

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Question 4

(a) Long-Term Evolution (LTE) – Advanced has been actively developed to offer higher data rates in both downlinks and uplinks in cellular communications.

(i) Coordinated Multi-point (CoMP) is one of the main features in LTE-Advanced technology. In which release (standard) of Third Generation Partnership Project (3GPP) that this feature is specified? (Hint: There are about 13 releases in 3GPP and the latest one is Release 12)

(ii) Briefly explain three forms of basic cooperative transmission techniques which are employed in communication networks.

(iii) Explain three types of user pairing schemes which can be implemented in LTE-Advanced systems.

(iv) A user pairing scheme is applied in an LTE-Advanced system with four users to select two pairs of users. The measured values of the channel quality and the correlation between every pair of users in the system are tabulated in Table Q4 (a). Determine the two pairs of users based on the maximal orthogonal pairing scheme.

[2+6+6+6 Marks]

Users Pairs	Channel Quality (bits/s/Hz)	Correlation
User 1 and User 2	20.0	0.512
User 1 and User 3	19.0	0.376
User 1 and User 4	19.3	0.625
User 2 and User 3	18.9	0.794
User 2 and User 4	21.7	0.418
User 3 and User 4	19.6	0.234

Table Q4 (a)

(b) Orthogonal Frequency Division Multiple Access (OFDMA) is the multi-user digital modulation scheme employed in both LTE-Advanced and Worldwide Interoperability for Microwave Access (WiMAX)

(i) Explain the relationship between OFDMA and OFDM.

(ii) Explain the differences between the OFDMA implementation in LTE and WiMAX.

[2+3 Marks]

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